$CeAl_{11}O_{18}$ phase (JCPDS card No. 48-0055). The another phase was thus identified as $SmAl_{11}O_{18}$ phase having the same crystalline structure as $CeAl_{11}O_{18}$. The presence of $SmAl_{11}O_{18}$ phase was confirmed by a phase diagram of Sm_2O_3-Al_2O_3 system shown in Fig. 3 (Phase Diagrams for Ceramists 1975 Supplement, Fig. 4369).

Fig. 4 shows the distribution of Sm atoms in the sintered body measured by EPMA. Fig. 5 shows the distribution of Sm atoms in the sintered body of the comparative example 3. Figs. 4 and 5 also show the distribution of N atoms, O atoms and Al atoms. In Figs. 4 and 5, the content of Sm atoms corresponds with the lightness in the photograph (refer to a color tone scale in the right column of the photograph). Further, Fig. 6 shows the enlarged view of the distribution of Sm atoms shown in Fig. 4, and Fig. 7 shows the enlarged view of the distribution of Sm atoms shown in Fig. 5.

As shown in Figs. 4 and 5, Sm phase was recognized in the sintered body according to the example 1 and comparative example 3. In the Sm phase, Sm atoms were distributed between AlN matrix forming spherical entities(designated as "spherical portions"). Further in the sintered body of the example 1, characteristic elongate portions were recognized. In the elongate portions, the content of Sm element was lower compared with that in the spherical portion. In other words, the spherical portions were brighter than the elongate portions. The elongate portions were distributed within the intergranular phase between AlN grains to form a kind of network-like entities. The substances constituting the spherical and elongate portions were identified by comparing the photographs by EPMA and the results of the above X-ray diffraction measurement. Consequently, it is assumed that the spherical portions with a higher content of Sm atoms are composed of SmAlO3 and the elongate portions forming network with a lower content of Sm atoms are

composed of $SmAl_{11}O_{18}$. It is speculated that the volume resistivity of the sintered body is reduced by the presence of $SmAl_{11}O_{18}$ phase in the intergranular layers between AlN grains, forming conductive pass.

(Examples 2 to 10)

The manufacturing condition of each sintered body and its properties were shown in tables 1 and 2.

When the AlN powder "B", "C" or "D" was used, substantially same properties as the example 1 were obtained within a certain range of the content of Sm_2O_3. Particularly when the AlN powder "C" with a low oxygen content was used, the content of Sm_2O_3 required for attaining a low volume resistivity shifted to a lower content range. On the other hand, when the AlN powder "D" with a high oxygen content was used, the content of Sm_2O_3 required for attaining a low volume resistivity shifted to a higher content range. The volume resistivity of the aluminum nitride sintered body may be controlled by adjusting the molar ratio of the contents of Sm_2O_3 to Al_2O_3, in addition to the content of Sm_2O_3 (molar ratio) alone.

(3) Comparative examples 6 to 8 (table 3)

The comparative example 6 was an AlN sintered body without an additive. Its volume resistivity at room temperature was high (2×10^{14} Ω・cm) and the activation energy of temperature dependency was high (1.0 eV : 150 to 400 ℃ : refer to Fig. 1).

Table 3

comparative example	raw powder			sintering condition	properties of sintered body									
	A l N powder		additive	sintering temperature	oxygen content	content of added metal element	bulk density	open porosity	resistivity 25℃	resistivity 300 ℃	activation energy	bending strength	thermal conductivity	average grain diameter of AlN
	type	oxygen content weight%		℃	weight %	weight%	g/cm3	%	Ω・cm	Ω・cm	e V	MPa	W/mK	μm
6	A	0 97	none	1800	0.80	—	3.26	0.04	2E+14	3E+09	0.59*	365	91	3
7	A	0.97	Y2O3	1900	0.84	0.22	3.27	0.02	8E+10	<1E+7	0.71**	333	92	7
8	A	0.97	CeO2	1900	0.83	0.37	3.27	0.03	7E+10	<1E+7	0.69**	312	100	6

★ temperature range for measurement : １５０～４００℃
★★temperature range for measurement : ２５～１７０℃